INVESTIGATIONS AND ANALYSES

Refer to the 1974 Work Plan – FEIS for specific methodology for each study area. As described below, additional work was done on specific issues as a part of this supplemental evaluation.

Geologic Investigation

A subsurface investigation was conducted in March 2005. The geologic investigation consisted of geologic mapping, exploratory borings, and test pits. The boring program consisted of 10 borings. Boring locations and depths were selected to characterize the subsurface conditions of the proposed dam location. Boreholes included both vertical and angled holes. The borings were drilled to depths ranging from 22 feet to 102.5 feet. The total aggregate length of all the borings was 565 feet. The test pit program consisted of 30 test pits. Embankment volumes were computed using AutoCAD. Volume of available on-site borrow material was estimated based on an extensive evaluation of the boring and test pit logs obtained from the subsurface investigation. It is anticipated that the material used to construct the embankment will come from the ASW excavation and from the sediment and flood pools above the dam and from a small area downstream of the dam. Rock excavation is anticipated during construction of the ASW on the Site16 dam. Volumes of excavation in the ASW were computed using AutoCAD.

A preliminary geologic investigation of Site 23 was conducted in May 1999. The geologic investigation consisted of geological mapping and test pits. The test pit program consisted of 16 test pits. Test pit locations were selected to characterize the availability of soil borrow material appropriate for a clay core (Zone I material) for the embankment.

Site 23 is underlain by the Devonian Hampshire Formation. The valley floor of Cullers Run in the area evaluated consists mainly of Potomac fine sandy loam and Tioga fine sandy loam.

Engineering

Planning investigations were conducted to determine final planning designs and costs for Site 16. Detailed topographic mapping and aerial photo coverage for Site 16 and the Lost River Valley were completed in 2005. The aerial photographs used in the development of the topographic maps were taken on March 18, 2005. Horizontal and vertical ground control was established by GPS and by detailed field surveys. New black and white aerial photography was obtained at nominal negative scales of 1 inch=800 feet and 1 inch=1,200 feet using a fully calibrated RC-30 precision mapping camera mounted in a twin engine aircraft. The aircraft was equipped with a GPS unit. The topographic mapping was compiled/digitized at a scale of 1 inch=200 feet with

2-foot contour intervals and index contours at 10-foot intervals. The maps were produced in AutoCAD format. Stage-area relationships for Site 16 were developed in AutoCAD. Stage-storage volumes were then computed using the average-end-area method.

The dam was proportioned using the NRCS SITES Program. SITES routed the estimated design-storm runoff from the contributing watershed through the dam. The principal spillway, auxiliary spillway, and top of dam routings were completed to determine the crest elevation of the principal spillway and auxiliary spillway and the elevation of the

top of dam. Delineation of the drainage area and determination of the reservoir characteristics were based on USGS topographic mapping, topographic mapping from aerial photography and land-based surveys, GIS databases, and field reconnaissance. The structure is planned with a single-stage principal spillway system composed of a standard Dx3D reinforced concrete drop inlet riser, a reinforced concrete pipe, and a reinforced concrete outlet basin resting on bedrock. The crest of the riser was set at the elevation of the sediment pool plus water supply pool. The sediment pool consists of 100-year sediment accumulation, approximately 212 acre-feet, and the water supply pool consists of 400 acre-feet of storage for water supply. The principal spillway was sized to empty the flood retarding pool in 10 days or less. Net flood storage was determined by routing the principal spillway storm through the riser and principal spillway structures without flow through the auxiliary spillway. The crest of the auxiliary spillway was set to store the net flood storage resulting from the 10-day, 100-year rainfall event, the sediment accumulation, and the water supply storage. Top of dam elevation was set by routing the freeboard design hydrograph resulting from the 6-hour Probable Maximum Precipitation (PMP) through the principal spillway and the auxiliary spillway structures. Several auxiliary spillway widths and PMP hydrographs were considered when determining the top of dam elevation. Final proportioning was accomplished by comparing cost of ASW excavation, embankment cost, and land rights cost. Three basic auxiliary spillway alignments were evaluated. The alignments include: the original configuration proposed in the 1970 investigation with the outlet channel discharging onto a relatively wide and flat pasture; a shorter curved spillway discharging around the south dam abutment and plunging over the steep abutment near the toe of the dam; and a straight alignment

discharging southward away from the dam into the adjacent hollow. The third alignment is the preferred alignment for the ASW at Site 16 to provide a more stable outlet away from the dam and to avoid potentially impacting a residence directly downstream of the originally planned ASW.

Site 16 is planned as a zoned earth and rock fill embankment with an impervious clay core and a rock shell. The slopes of the embankment are 3:1 upstream and downstream to provide adequate stability. A chimney drain will be constructed on the downstream side of the impervious core to control seepage through the core and act as a filter and transition zone.

Construction cost estimates for Site 16 were based on computed quantities of all items with an allowance of 20 percent for contingencies. Unit prices were developed from a study of similar projects in the past in WV.

A safe yield analysis was conducted as part of the planning process to determine the adequacy of Site 16 for water supply.

Economics

Costs and benefits were updated from the 1974 Work Plan – FEIS using the Consumer Price Index, the Engineering News Record, and other appropriate indexes. Categories of flood damages were reviewed for accuracy and verified by field reviews of the watershed.

A recreational study was done in 2004 to determine the present need for recreational facilities at Site 16. The study concluded that recreational needs were being met and, based on this information, Sponsors requested to eliminate this project purpose. Incidental recreation benefits were determined using the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation and user day information from the West Virginia Division of Natural Resources, updated to current dollar values.

Water supply needs were determined by the Sponsors, with assistance from NRCS. Census information, highway development, housing growth, and information contained in the 2004 Hardy County Water Resources Study were used. Water supply benefits were determined using the methods described in Section 2 of Principles and Guidelines and the National Watershed Manual.

Census information, input from local sponsors, guidance from the county field office and other sources were used to identify any environmental injustice issues. No issues were identified through any of these means. Additionally, no disproportionate effects on any groups of people were identified during the public scoping process.

All costs and benefits were based on 2006 prices. Costs and benefits were amortized at 5.125% for 100 years. All other categories of benefits were computed as described in the 1974 Work Plan – FEIS.

Hydrology and Hydraulics

Hydrologic and hydraulic investigations consisted of an analysis of rainfall runoff relationships using computer models of the watershed. The models were calibrated by comparing the output files to the previous modeling done for the 1974 Work Plan – FEIS, which were calibrated to a reproduction of an actual storm event and matching surveyed high water marks. Rainfall data was obtained from NOAA Atlas 14. Soils data was obtained from the Soil Survey of Grant and Hardy Counties, West Virginia. Land use information was coordinated with local NRCS field office personnel. Hydrologic soil-cover complexes and runoff curve numbers were computed using the procedures in the NRCS National Engineering Handbook, Section 4. Storm runoff was estimated using the runoff curve number method.

Cross section data were obtained from topographic mapping, with a 2-foot contour interval, developed for this study. Cross section locations were selected to reflect the flood stages at points of damage, restriction and grade control. All bridges and culverts were field surveyed to obtain structural geometry in order to compute the backwater effects of those structures. Elevations for the mapping and surveying were referenced to the North American Vertical Datum of 1988.

Channel and floodplain geometry and roughness factors (Manning's "n") for the watershed were assigned on the basis of field inspection of the streams and their adjacent areas.

Flood routings were performed using procedures in NRCS Technical Release No. 20 (TR-20). Various frequency one-day storms were routed to establish discharge-frequency relationships.

Water surface elevations were computed using the NRCS WSP-2 computer program as described in Technical Release No. 61. Flood profiles were drawn showing computed water surface elevations for the selected recurrence intervals.

Cultural Resources

Of the four sites recommended for Phase II testing, one is on a terrace on the south side of Lower Cove Run. This site is a moderate-density lithic scatter with diagnostic projectile points, tools, and nearly 100 pieces of debitage. This area is currently used as a hay field. Another site is a cluster of small rockshelters at the upstream end (east) of the project area, on the north side of Lower Cove Run road. The other two sites recommended for Phase II testing are in the floodplain on the north side of Lower Cove Run. One of these sites is a small low-density lithic scatter made up of about 20 pieces of debitage and one broken point tip. This area is currently used as pasture. The fourth site recommended for Phase II work is a moderate-density lithic scatter spread over a large area. Approximately 135 pieces of debitage, one core fragment, and three scrapers were recovered. This area is currently used as a hay field. Any cultural resources located on Forest Service lands impacted by the project will be investigated and mitigated to the extent deemed necessary by the Forest Service.